REMARKS

Claims 1-4, 6-11, 13-18, 20-25, 27-32, 34-38, 40-47, and 49-57, all the claims pending in the application, stand rejected on prior art grounds. Applicants respectfully traverse these rejections based on the following discussion.

I. The Prior Art Rejections

Claims 1-4, 6, 8-11, 13, 15-18, 20, 22-25, 27, 29-32, 34, 36-38, 40-41, 43-47, and 50-57 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Reiner, et al. (U.S. Patent No. 6,289,334) hereinafter referred to as Reiner, in view of Koskas (U.S. Patent No. 6,711,563). Claims 7, 14, 21, 28, 35, 42, and 49 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Reiner, in view of Koskas, and in further view of Jagadish, et al. (U.S. Patent No. 7,010,522) hereinafter referred to as Jagadish. Applicants respectfully traverse these rejections based on the following discussion.

Specifically, Applicants respectfully traverse these rejections because the cited prior art references do not teach or suggest a method, service or system related to maintaining and using a query index to support continual query monitoring, as claimed in amended independent claims 1, 9, 16, 23, 30, 37 and 44. More specifically, the cited prior art references do not teach or suggest several of the same or similar patentable features of amended independent claims 1, 9, 16, 23, 30, 37 and 44, including, but not limited to: (1) "defining groups of virtual construct intervals, wherein said virtual construct intervals represent predetermined ranges of data values and correspond to specific bit positions in bit map vectors;" (2) "determining predicate intervals, wherein

said predicate intervals represent specified ranges of data values from continual queries"; and (3) "inserting each of said predicate intervals into said bit map positions of at least one of said groups of said virtual construct intervals such that said specified ranges of data values of said predicate intervals are aligned with said predetermined ranges of said data values of said virtual construct intervals".

The present invention is a method and system for maintaining and using a query index to support continuing queries/rules, where each continual query/rule in the query index has a predicate interval. Continual query services and other information dissemination services have become popular (see paragraph [0003]). Users can subscribe to such services with a provider via the web. The present invention supports efficient continual query monitoring (see paragraph [0007] and [0017]). Specifically, users input interests in the form of interval predicates in continual queries/rules into the system (see paragraph [0019]). The predicate intervals represent the range of data values that a user is interested in and that are specified in the continual query/rule received by the system from a user (see paragraph [0017]). These predicate intervals are used for indexing. As discussed in paragraphs [0029-0031] and illustrated in the Figures, this is accomplished by defining groups of virtual construct intervals (VCI) (i.e., intervals representing predetermine ranges of data values) and inserting the predicate intervals from the continual queries (once determined) into bit map positions corresponding to the virtual construct intervals. Specifically, each VCI is defined so that it represents a predetermined range of data values and corresponds to specified bit map positions in bitmap vectors. When a continual query (or subscription or rule, etc.) is received, its

predicate interval is determined and this determined predicate interval is inserted into the bit map positions of the VCI to which it aligns (i.e., for which is has the same data values).

Contrarily, Reiner provides an "Apparatus and method for decomposing database queries for database management system including multiprocessor digital processing system" (see title). That is, Reiner provides an improved DBMS that intercepts and decomposes database queries into subqueries, where each subquery represents a request for access to data stored in a specific table partition (see col. 2, lines 61-col. 3, line 3). Another aspect of the invention is the use of "an indexing element to index each stored data record for direct access in accord with a respective value of that data record". When a request to access a data record is received, the indexing element is invoked to retrieve that record in accord with the index value (see col. 4, lines 24-38). Specifically, per col. 10, lines 53-61: "In operation, the DBMS 76 responds to requests to store data records by invoking the hashing element 76B to store those data records in accord with a hash on their key values. The DBMS 76 also populates index 76C by invoking DBMS's 76 corresponding indexing functionality. When accessing data records, the decomposer 74A generates subqueries specifying that requested data records are to be accessed via the index element 76c, not the hashing element 76b." That is, in addition to specifying a specific table partition, subqueries can specify that requested data records are to be accessed via the index element. The index referred to is an index of the stored data, not an index of queries. No wherein in Reiner does it teach or suggest maintaining and using an index for the queries themselves to support continual query monitoring. Reiner does

not address continual queries and thus would have no need to index such queries.

The Office Action provides that Reiner dislcoses "defining groups of virtual construct intervals (Col. 2 and 8, lines 65-67 and 37-40; respectively, ... generates multiple subqueries ..., Reiner), wherein said virtual construct intervals represent predetermined ranges of data values (Col. 26, lines 64-66, Reiner)." The Office Action further provides that Reiner also discloses "bitmap (Col. 63, lines 36-38, Reiner). However, Reiner does not explicitly disclose specific bit positions in bit map vectors." Therefore, the Office Action cites Koskas (Col. 11, lines 3-10) as disclosing this feature. The Applicant's respectfully disagree.

As mentioned above, Reiner teaches an improved DBMS that intercepts and decomposes database queries into subqueries, where each subquery represents a request for access to data stored in a specific table partition (see col. 2, lines 61-col. 3, line 3). Col. 8, lines 37-40 reiterate that the system generates from a decomposable query a set of subqueries, where each subqueries is based on the initial query but is further directed to data in one or more respective partitions. That is, the subqueries of Reiner are generated by decomposing the initial query. Contrarily, the virtual construct intervals of the present invention are defined so that they "represent predetermined ranges of data values" and so that they "correspond to specific bit positions in bit map vectors". That is, the virtual construct intervals of the present invention, as claimed, are not queries, are not subqueries and are further not generated based on any query or subquery. They simply are defined to represent predetermined ranges of data values and to correspond to specific bit positions in bit map vectors.

Furthermore, Koskas teaches a "method of organizing data and processing queries in a database system ..." (see title). Specifically, according to the Abstract, Koskas teaches "a reference table has columns associated with data attributes and rows containing related words assigned to those attributes in a collection of data, those words coming from different data tables having independent numbers of records. The stored data include word thesauruses associated with the attributes, and reference table row identifier lists respectively associated with thesaurus entries. Each word thesaurus associated with an attribute has a respective entry for each word assigned to this data attribute in the collection of data. The reference table, which may be a virtual table, defines a unified algebraic framework for the entries of all the thesauruses. Query criteria can be examined with reference to the relevant thesauruses to obtain a row-ID list or bitmap vector which represents all the reference table rows matching the query criteria, if any. The results can then be delivered through the original data tables or, preferably, by means of the thesauruses." The cited portion of Koskas describes the bitmap vectors (e.g., the length), which, as discussed above, represent reference table rows that match certain query criteria. Nothing in the cited portion of Koskas discloses specific bit positions in bit map vectors that correspond to predetermined ranges of data values (i.e., to specific virtual construct intervals).

The Office Action cites col. 26, lines 64-66 of Reiner as disclosing the feature of "determining predicate intervals, wherein said predicate intervals represent specified ranges of data values from at least one of subscriptions, queries and rules." The feature has been amended to "determining predicate intervals, wherein said predicate intervals

represent specified ranges of data values from continual queries". None of the cited prior art references include the feature continual queries or discuss how such continual queries might be handled. That is, the cited prior art references discuss receiving a query, accessing a database and responding to the query with data stored in the database. However, the query that is received is not continual.

Furthermore, col. 26, lines 64-66 provides: "When a subquery finds an index entry for DEPTNO 5, however, it will examine the rowed stored in that index entry, to see whether it fall within the range for that subquery." However, as discussed in col. 26, lines 19-64, the "range" referred in the cited portion of Reiner is not a range of data values from the query (as in the claimed invention), but rather is a range of rowids (e.g., ROWID>=0.0.1 and ROWID<0.0.2) that is set out in each subquery (as generated from the decomposed query) and is used to "specify one or more files to which that query's reads will be restricted."

The Office Action further provides that Reiner and Koskas in combination disclose "inserting each of said predicate intervals into said bit map positions of at least one of said groups of said virtual construct intervals" (Col. 9, lines 12-13 and 27-28, ... appending a predicate for matching records in the corresponding table partitions .., Reiner; and Col. 11, lines 3-10, Koskas) such that said specified ranges of data values of said predicate intervals are aligned with said predetermined ranges of said data values of said construct intervals (Col., 9, lines 36-39, Reiner; and Col. 11, lines 3-10, Koskas)." The Applicants respectfully disagree.

Col. 9, lines 9-13 of Reiner states "the decomposer 74A generates corresponding

.subqueries by duplicating the query and appending a predicate for matching records in the corresponding table partition." Col. 9, lines 15-20 of Reiner provide an exemplary original query and col. 9, lines 24-29 provide an exemplary one of the sub-queries (as derived from the original query), wherein the sub-query refers to a particular data partition. The exemplary original query of col. 9, lines 15-20 does not include a predicate interval (i.e., a specified range of data values). The "predicate" that is referred to in col. 9, lines 9-13 refers to a condition set on the subsequently formed sub-queries in order to limit retrieval of data from a specific partition (i.e., a read restriction). Thus, what is described in Reiner is inserting a predicate table partition into a query so that the resulting subquery includes a read restriction (i.e., is limited to accessing only a specific portion of the table).

The cited portion of Koskas describes bitmap vectors which represent reference table rows (which contain related words assigned to certain attributes in a collection of data) that match certain query criteria. However, nothing in either Reiner or Koskas teaches or suggests inserting predicate intervals (that, as claimed, represent specified ranges of data values from continual queries) into bit map positions that corresponds to a defined virtual construct interval (i.e., to a predetermined range of data values).

Furthermore, col. 9, lines 12-13 and 27-28 of Reiner describes in detail the exact same feature of Reiner that is summarized in col. 2, lines 65-67 and col. 8, lines 37-40 and that the Examiner has previously cited as disclosing the feature of "defining groups of virtual construct intervals." The "defining" and "inserting" features of the present invention are distinct patentable features and, thus, the same exact feature of Reiner can

not disclose both of the patentable features of the present invention.

Therefore, amended independent claims 1, 9, 16, 23, 30, 37 and 44 are patentable the cited prior art references. Further, dependent claims 2-4, 6-8, 10-11, 13-15, 17-18, 20-22, 24-25, 27-29, 31-32, 34-36, 38, 40-43, 45-47, 49-57 are similarly patentable, not only by virtue of their dependency from a patentable independent claim, but also by virtue of the additional features of the invention they define. Moreover, the Applicants note that all claims are properly supported in the specification and accompanying drawings, and no new matter is being added. In view of the foregoing, the Examiner is respectfully requested to reconsider and withdraw the rejections.

III. Formal Matters and Conclusion

With respect to the rejections to the claims, the claims have been amended, above, to overcome these rejections. In view of the foregoing, the Examiner is respectfully requested to reconsider and withdraw the rejections to the claims.

In view of the foregoing, Applicants submit that claims 1-4, 6-11, 13-18, 20-25, 27-32, 34-38, 40-47, and 49-57, all the claims presently pending in the application, are patentably distinct from the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary. Please charge any deficiencies and credit any overpayments to Attorney's Deposit Account Number 50-0510.

Respectfully submitted,

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/Pamela M. Riley/
Pamela M. Riley
Registration No. 40,146

Gibb & Rahman, LLC
2568-A Riva Road, Suite 304
Annapolis, MD 21401
Voice: (410) 573-0227
Fax: (301) 261-8825
Customer Number: 29154